CASE FILE TRACKING SYSTEM FOR BADRUL LEE & ASSOCIATES

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ABSTRACT

Locating items in a huge collection is becoming more and more difficult and time consuming. This appears to be a problem especially in time essential environments such as business environments. With current technology this problem can be solved. RFID is a blooming technology with many different applications. It is currently mostly used in stock management and theft control systems as seen in libraries and shopping complexes. There are also applications of RFID in item tracking but not on a commercial scale and it is done with static objects. However, there lies a possibility of RFID tracking moving objects in real-time. Technology is advancing day by day and it is exists to assist people to live in comfort.

ABSTRAK

Pencarian barang di dalam koleksi yang besar menjadi semakin mencabar dan memakan masa. Ini menjadi suatu masalah, terutamanya di persekitaran yang mementingkan masa contohnya persekitaran perniagaan. Dengan teknologi terkini masalah ini dapat diselesaikan. RFID merupakan satu teknologi yang sedang pesat berkembang degan pelbagai aplikasi. Ia kebanyakan diguna untuk pengurusan stok dan system kawalan pencurian sebagaimana dilihat di perpustakaan-perpustakaan dan kompleks membeli-belah. Terdapat juga aplikasi RFID dalam pelacakan barangan tetapi bukan secara komersial dan ia dilaksanakan degan objek static. Akan tetapi adanya kemungkinan RFID melacak objek bergerak dalam masa sebenar. Teknologi sedang berkembang setiap hari dan ia wujud untuk membantu manusia hidup dengan selesa.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

Case File Tracking System for Badrul Lee & Associates shall be referred to as CTFS from here hence forth. CTFS is a system which is capable of tracking the location of case files within the office area using Radio Frequency Identification Technology (RFID). CTFS is an intranet system for the usage of company staffs only. CTFS contain a few modules which include login & registration, search & locate and check-in & check-out. Registered staffs will first login into the system. Then they can input their search criteria such as filename to begin their search. The system will search and locate the existence of the file and its location within the company office. The location of the file will then be displayed on the monitor if successful. Finally, the staff can retrieve the file manually without having the need to ransack the entire company archive.

1.1 Problem Statement

First, currently there is no existing software which is capable of locating an item within a local area. Secondly, the efforts of searching for an item such as a case file within a law firm is time consuming, unsystematic and risk of human error. Thus, it causes a waste of valuable human resources and time. Finally, the additional stress cause by the manual labour of locating case files impairs the company staffs to perform in their optimal condition. Therefore, it is important to lower such unnecessary burden on the staffs to achieve an efficient and quality working environment.

1.2 Objective

The objectives of this project are:

I. To search the location of case files within a contained area in limited time
II. To reduce the number of times staff finding wrong files
III. To reduce the amount of time taken to search and locate case files.

1.3 Scope

The scope of this project is:

I. Detect the location file within 30 seconds
II. Search the availability of case files in database
III. System is allowed to search only one file per search
IV. Locations of files are displayed via top view only.
V. System is an intranet system that uses .Net and RFID technology

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter explains and discusses about the related information to Case File Tracking System. Case File Tracking System is an application developed for Badrul Lee & Associates Law Firm to help track and locate the position of case files using RFID technology for a more efficient working environment.

2.1 The Current System

At Badrul Lee & Associates, everyday new case files are open or created. These case files are used and can be accessed by anyone of the staffs of the firm. After so many years of business, the collection of case files has become very large because case files are only opened and closed but never are they destroyed or discarded for the purpose of keeping a case record of their clients. From time to time, the staffs of the firm especially the lawyers need to search for specific case files amongst their large archive to update their client's latest information and also legal matters. This is all done manually which costs the staffs to waste a significant amount of time to locate the case file if it is in the archives or it is with a staff which is not productive as time happens to be an important asset to these professional workers.

In addition, the case files have a unique labeling based on an agreed standard of the firm. This unique labeling happens to be a long string of alphabets and numbers. Example of the labeling is CC/09/TTDI/LJH/04 where CC refers to the type of case (e.g. property, agreements, etc.), 09 refer to the year, TTDI refers to the place, LJH are initials of the client and 04 is the number of the case file. The labeling also is done in manual. This causes two problems which is different case files risk of having the same label thus causes confusion and case files risk of being mistaken when search by staffs thus causes lose of time as staffs need to re-search the correct file.

Lastly, staffs are permitted to bring the case files home with them for work purposes. This causes redundant work as there are possibilities where the case files searched is not within the office area.

2.2 RFID Technology

Radio Frequency Identification (RFID) is a system that transmits the identity (in the form of a unique serial number) of an object or person wirelessly, using radio waves. It is grouped under the broad category of automatic identification technologies.

Auto-ID technologies include barcodes, optical character readers and some biometric technologies, such as retinal scans. The auto-ID technologies have been used to reduce the amount of time and labour needed to input data manually and to improve data accuracy.

Some auto-ID technologies, such as barcode systems, often require a person to manually scan a label or tag to capture the data. RFID is designed to enable readers to capture data on tags and transmit it to a computer system—without needing a person to be involved.

2.2.1 RFID Tags

A typical RFID tag consists of a microchip attached to a radio antenna mounted on a substrate. The chip can store as much as 2 kilobytes of data. The vast majority of RFID tags or transponders use a silicon microchip to store a unique serial number and usually some additional information. For example, information about a product or shipment date of manufacture, destination and sell-by date can be written to a tag. There are two categories of RFID tags, passive and active tags.

Passive RFID tags do not have a transmitter; they simply reflect back energy coming from the reader antenna. They are cheaper than active tags and require no maintenance. They have a much shorter read range than active tags which is a few inches to 30 feet. A passive RFID transponder consists of a microchip attached to an antenna. The transponder can be packaged in many different ways. It can be mounted on a substrate to create a tag, or sandwiched between an adhesive layer and a paper label to create a printable RFID label, or smart label. Transponders can also be embedded in a plastic card, a key fob, the walls of a plastic container, and special packaging to resist heat, cold or harsh cleaning chemicals. The form factor used depends on the application, but packaging the transponder adds significantly to the cost. Passive tags can operate at low frequency, high frequency and ultra-high frequency. Low-frequency systems generally operate at 124 kHz, 125 kHz or 135 kHz. High-frequency systems use 13.56 MHz, and ultra-high frequency systems use a band anywhere from 860 MHz to 960 MHz. Some systems also use 2.45 Ghz and other areas of the radio spectrum. Low-frequency tags can usually be read from within 12 inches (0.33 meter). High frequency tags can be read from up to 3 feet (1 meter), and UHF tags can be read from 10 feet or more.

Active tags have their own transmitter and a power source, usually a battery. Active tags broadcast a signal to transmit the information stored on the microchip. Active tags are used on large assets, such as cargo containers, rail cars and large reusable containers, which need to be tracked over long distances. They usually operate at 455 MHz, 2.45 GHz, or 5.8 Ghz, and they typically have a read range of 60 feet to 300 feet. There are two types of active tags: transponders and beacons. Active transponders are woken up when they receive a signal from a reader. These are usually used in toll payment collection, checkpoint control and other systems. Beacons are used in most real-time locating systems (RTLS), where the precise location of an asset needs to be tracked. RTLS are usually used outside. Active tags generally cost from $10 to $50, depending on the amount of memory, the battery life required, whether the tag includes an on-board temperature sensor or other sensors, and the ruggedness required. A thicker, more durable plastic housing will increase the cost.

2.2.2 RFID Readers

Readers either have internal or external antennas. Readers with external antennas can have one or more ports for connecting reader antennas (latest readers have up to eight antenna ports). Readers can also have input/output ports for connecting to external devices. An input port might be connected to an electric eye that runs on the reader when something breaks its beam. An output port might connect to a program logic controller, conveyor sorter or other device controlled by the reader. Readers also have ports for connecting to a computer or network. Older readers use serial ports. Most new readers have Ethernet, Wi-Fi or USB ports.

2.2.3 RFID Standards

The International Organization for Standardization (ISO) has created standards for tracking cattle with RFID. Table 2.2-1 shows the few ISO standards for RFID.

ISO Standard	**Description**
ISO 11784	Defines how data is structured on the tag
ISO 11785	Defines the air interface protocol
ISO 14443	Air interface protocol for RFID tags used in payment systems and contactless smart cards
ISO 15693	Vicinity cards
ISO 18047	Testing the conformance of RFID tags and readers to a standard
ISO 18046	Testing the performance of RFID tags and readers

Table 2.1: ISO Standards

2.3 Related Systems

The following sections are research on current system which are using RFID.

2.3.1 RFID Technology for Libraries

The information contained on microchips in the tags affixed to library materials is read using radio frequency technology regardless of item orientation or alignment and distance from the item is not a critical factor except in the case of extra-wide exit gates. The corridors at the building exits can be as wide as four feet because the tags can be read at a distance of up to two feet by each of two parallel exit sensors.

2.3.2 Indoor RFID Tracking

TagMobile is the brand name of the RFID Centre active real-time location and tracking system which incorporates both hardware and software in an integrated solution. TagMobile is a highly configurable system that provides superior indoor positional accuracy to all other systems as it uses patented tri-technology allowing the intelligent tag to ascertain its location with 100% certainty. TagMobile will locate and record the movements of people and objects anywhere within its predefined reader network. It can govern those movements with a system of rules based on associated events and actions such as an asset passing into a particular zone within the building. Figure 2.1 shows TagMobile system architecure within a hospital environment.

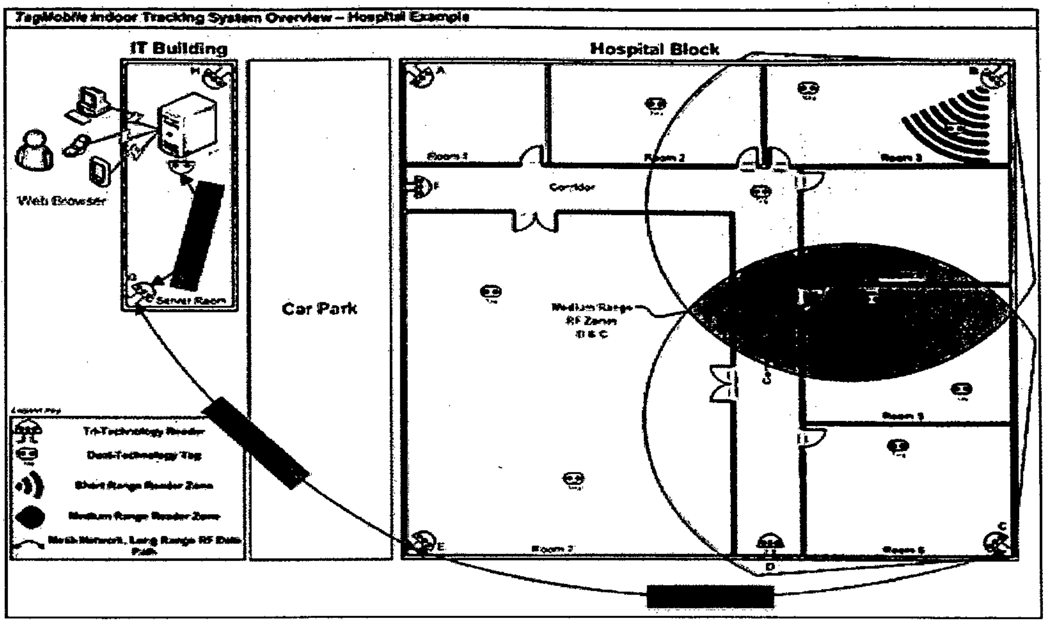

Figure 2.1: TagMobile in Hospital

TagMobile is scalable from a standalone department system to a campus wide network and can be customized to meet user's specific process requirements. TagMobile can be installed as a completely wireless system using WiFi or Ethernet TCP/IP or a combination of the two to send positional data back to the central system with the lowest implementation costs. With appropriate password security authorized staff can then access the server to view the location of those assets or people from anywhere within the organization.

2.3.3 Automatic, Up-to-Date Equipment Tracking

To gain better information about IT equipment location and movement, Cisco is launching a pilot project for radio frequency identification (RFID)-based asset tracking in its Amsterdam data center. This project will use technologies such as Cisco's corporate wireless LAN, location-based services, and RFID for real-time tracking of all equipment in that data center. Cisco's internal wireless LAN detects equipment with active RFID tags, and then sends the equipment location data to an internally-developed asset-tracking application.

This implementation will replace manual updates of inventory data with automatically collected, near-real-time data about equipment location. All devices in the Amsterdam data center will receive active RFID tags for tracking, allowing Cisco IT to conduct a full test of this solution in a production environment.

The WLAN in the Amsterdam data center will use Cisco Aironet 1100 Series access points and the Cisco Wireless Location Appliance to detect the active RFID tags. The Cisco Wireless Control System and Cisco 2700 Series Location Appliance will correlate the RFID data to show equipment location on a floor map display. This solution identifies the location of a tagged device within 5–10 meters.

When the equipment is installed, the data center staff verifies and enters its physical rack location in net asset tracking system, which gives a more precise location. Future manual audits only need to be performed on equipment assets that have been detected as having moved, which eliminates the need to physically audit an entire data center.

The relatively small size of the Amsterdam data center makes it an attractive environment for Cisco IT's first production-scale testing of RFID-based asset tracking. In addition, all equipment in that data center is managed by a single team, which is the management model Cisco will use in its new production data center in Richardson, Texas.

2.3.4 Asset Tracking in Hospital

With the RFID system, Memorial Hospital's workers receive new products in an inventory room near the receiving dock, scanning each product's bar-coded serial number using a bar-code scanner on a WaveMark desktop reader cabled to a computer. They then use the same desktop device to read a passive 13.56 MHz ISO 15693-compliant RFID tag and attach it to the product, linking that tag's ID number with the bar-coded serial number and other information regarding the product, such as its type, size, expiration date and cost to a patient.

Prior to surgical use, products are stored in cabinets located in various labs. There are 10 cabinets altogether—six fitted with shelves, as well as four specifically designed for hanging products, such as catheters and wires. Within each cabinet are multiple RFID readers—typically, one per shelf, according to WaveMark's director of marketing, Colleen Terry. The interrogators capture the tags' unique ID numbers, forwarding them approximately every 20 minutes to software running on WaveMark's Internet-based server, via an Ethernet cable, along with a time and date stamp.

When an item is removed, the cabinet reader ceases to transmit its ID number to the back-end system. The WaveMark software thus determines that the product has been removed, and changes its status to "missing." If the item is to be used during surgery, it is taken to a surgical room where employees use a handheld WaveMark RFID/bar-code reader to scan the bar-coded number on a patient's ID bracelet, then interrogate the item's RFID tag, linking the patient with that product. A bill to that patient for that particular item is then generated by a health-care software application from MediTech.

If a predetermined span of time passes without the product being scanned with a patient's ID number, WaveMark software generates an alert indicating the item is missing and not linked to a patient.

2.4 Triangulation

In trigonometry and geometry, triangulation is the process of determining the location of a point by measuring angles to it from known points at either end of a fixed baseline, rather than measuring distances to the point directly. The point can then be fixed as the third point of a triangle with one known side and two known angles.

Triangulation can also refer to the accurate surveying of systems of very large triangles, called triangulation networks. This followed from the work of Willebrord Snell in 1615-17, who showed how a point could be located from the angles subtended from three known points, but measured at the new unknown point rather than the previously fixed points, a problem called resectioning. Surveying error is minimised if a mesh of triangles at the largest appropriate scale is established first, that points inside the triangles can all then be accurately located with reference to. Such triangulation methods dominated accurate large-scale land surveying until the rise of Global navigation satellite systems in the 1980s.

2.4.1 Current Triangulation Applications

The following sections are research on current applications of triangulation.

2.4.1.1 Optical 3D measuring System

Optical 3d measuring systems use this principle in order to determine the spatial dimensions and the geometry of an item. Basically, the configuration consists of two sensors observing the item. One of the sensors is typically a digital camera device, and the other one can also be a camera or a light projector. The projection centers of the sensors and the considered point on the object's surface define a (spatial) triangle. Within this triangle, the distance between the sensors is the base b and must be known. By determining the angles between the projection rays of the sensors and the basis, the intersection point, and thus the 3d coordinate, is calculated from the triangular relations.

2.4.1.2 Triangulation Using Earthquake Waves

Earthquakes give off two kinds of waves. One kind is always faster than the other. The longer distance the waves travel, the more "ahead" the faster kind gets. If a place feels both kinds of Earthquake waves, it can figure out how far away the center of the Earthquake was. In figure 2.2 the waves tell scientists that the quake was 300 km away from Boise. Scientists can then draw a circle around Boise so that every point on the circle is 300 km from Boise. The Earthquake is somewhere on that circle.

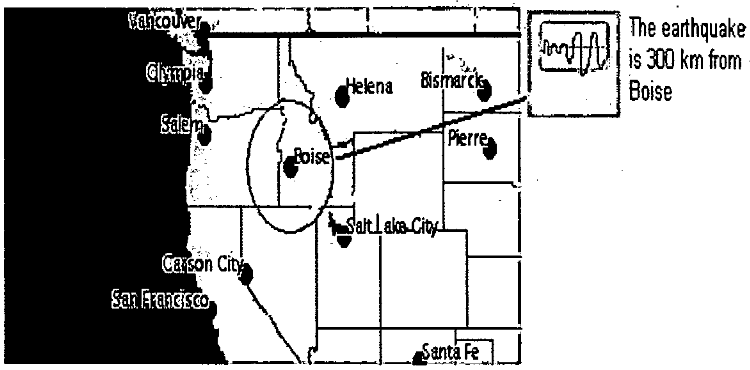

Figure 2.2: Pinpoint Earthquake 1

Other cities near Boise can also tell how far away the quake was. The quake is 500 km from Helena, so the scientists draw a 500 km radius circle around Helena. The Helena and Boise circles meet in two places. One of those was where the Earthquake happened. Figure 2.3 shows the intersection of the circles.

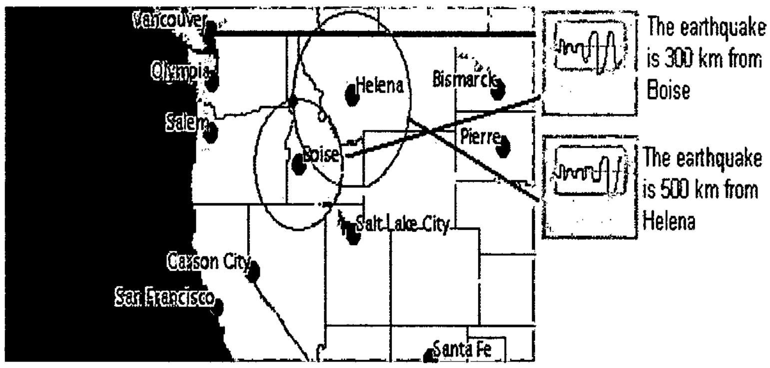

Figure 2.3: Pinpoint Earthquake 2

To decide between the two, a third station is needed. The distance between the third station and the Earthquake is used to figure out where the Earthquake happened. The quake is 150 km from Salt Lake City. A circle around Salt Lake City hits one of the two dots and that tells us where the Earthquake is. Figure 2.4 shows the pin-pointing of the earthquake using three points as reference.

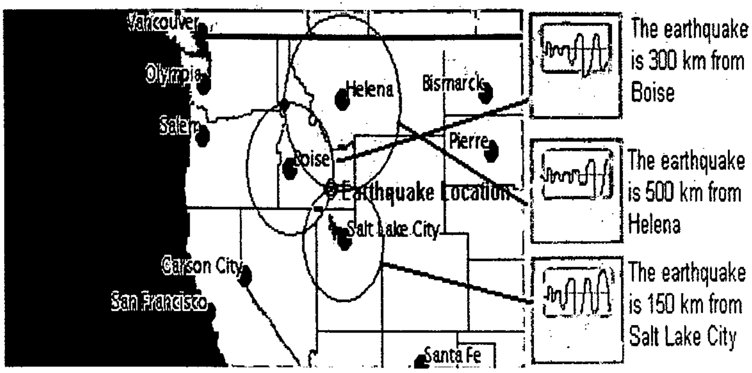

Figure 2.4: Pinpoint Earthquake 3

2.4.2 Triangulation Calculations:

Figure 2.5 shows the triangulation formula.

Calculation:

$$l = \frac{d}{\tan\alpha} + \frac{d}{\tan\beta}$$

Therefore

$$d = l \,/\, \left(\frac{1}{\tan\alpha} + \frac{1}{\tan\beta}\right)$$

Figure 2.5: Triangulation Calculation

Alternative calculation:

Alternatively, the distance RC can be calculated by using the law of sines to calculate the lengths of the sides of the triangle:

$$\boxed{\frac{\sin\alpha}{BC} = \frac{\sin\beta}{AC} = \frac{\sin\gamma}{AB}}$$

Figure 2.6: Alternative Calculation

The distance AB is known, so we can write the lengths of the other two sides as in figure 2.7

$$AC = \frac{AB \cdot \sin\beta}{\sin\gamma} \qquad BC = \frac{AB \cdot \sin\alpha}{\sin\gamma}$$

Figure 2.7: Known AB

RC can now be calculated using either the sine of the angle α, or the sine of the angle β as shown in figure 2.8.

$$RC = AC \cdot \sin\alpha$$
$$RC = BC \cdot \sin\beta$$

Figure 2.8: Calculate RC

Either way, this gives the result in figure 2.9.

$$RC = \frac{AB \cdot \sin\alpha \cdot \sin\beta}{\sin\gamma}$$

Figure 2.9: Result

We know that $\gamma = 180 - \alpha - \beta$, since the sum of the three angles in any triangle is known to be 180 degrees; and since $\sin(\theta) = \sin(180 - \theta)$, we can therefore write $\sin(\gamma)=\sin(\alpha+\beta)$, to give the final formula in figure 2.10.

$$RC = \frac{AB \cdot \sin\alpha \cdot \sin\beta}{\sin(\alpha + \beta)}$$

Figure 2.10: Final Formula

This formula can be shown to be equivalent to the result from the previous calculation by using the trigonometric identity $\sin(\alpha + \beta) = \sin\alpha \cos\beta + \cos\alpha \sin\beta$.